Determination of the Effective Thermal Conductivity of Hollow Bricks Using a Modified Guarded Hot Plate Method

Zbyšek Pavlík [C, S], Miloš Jerman, Václav Kočí, Jiří Maděra and Robert Černý
Czech Technical University in Prague, Faculty of Civil Engineering, Department of Materials Engineering and Chemistry, Prague 6, Czech Republic
pavlikz@fsv.cvut.cz

The brick blocks with complex systems of internal cavities being produced all over the world during the last few decades almost completely replaced the traditional bricks and became dominant on the building ceramics market. Contrary to solid bricks where thermal conductivity can easily be measured by standard guarded hot plate, hot wire or flash methods, the complex geometry of hollow brick blocks makes application of common methods impossible. Therefore, alternative experimental or computational treatments are being sought to determine effective (or equivalent) thermal conductivity of hollow bricks. In this paper, a modified guarded hot plate method for the determination of the effective thermal conductivity of hollow bricks is presented. The experimental setup involves an application of a thermal insulation box of expanded polystyrene and a set of temperature and heat flux probes placed at characteristic positions of the specimen-insulating box system. Using the measured heat fluxes and temperatures, the heat loss of the system is assessed. The computer simulation tool HEMOT, developed at the Department of Materials Engineering and Chemistry, Faculty of Civil Engineering, Czech Technical University in Prague and based on the finite element principle, is then used for modeling the temperature fields and heat losses in the studied system. Finally, the effective thermal conductivity is identified using a computational backward analysis, matching the measured and calculated data by an optimization procedure.